LTCC SURFACE MOUNT

Thru-Line

TPHKI-3002+

50Ω DC to 30 GHz

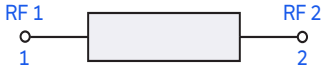
THE BIG DEAL

- LTCC Thru-line with Integrated Interposer Board
- Return Loss, Typ. ≥8 dB up to 30 GHz
- Small Size, 4.95 mm x 3.65 mm
- Shielded Construction
- Protected by US Patents 11,638,370 and 11,744,057



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- Test & Measurement Equipment
- Aerospace and Defense Signal Conditioning
- EW, Radar, and ECM Defense Systems
- 5G MIMO and Back Haul Radio
- Satellite Communications

PRODUCT OVERVIEW

Mini-Circuits' TPHKI-3002+ is a miniature low-temperature co-fired ceramic (LTCC) 50-Ohm transmission line with a low insertion loss of 1.3 dB typical up to 30 GHz. This can be used as a placeholder in system boards in the absence of LTCC Filters of the same case style, NM3237.

KEY FEATURES

Features	Advantages
Footprint Compatible "Thru-Line" for Mini-Circuits Filters (BFHKI Series), in Case Style NM3237 with same Pad Connections as BFHKI	Enables system designers the flexibility to plan to add LTCC filters to the PCB layout at a later stage in the design process, after system test results are available.
Surface Mountable due to Integrated Interposer Board	Enables installation with automated manufacturing equipment making this suitable for high-volume processes.
Small Size (4.95 x 3.65 mm)	Allows for high layout density of circuit boards, while minimizing effects of parasitics.
Wide Operating and Storage Temperature, -55 to +125°C	Enables use in high reliability and extreme environment condition such as aerospace & defense applications.
Cost Effective	LTCC is a scalable technology that is cost effective due to ease of production in high-volume.

REV. OR
ECO-020956
TPHK-3002+
MCL NY
240222

ELECTRICAL SPECIFICATIONS[1,2,3] AT +25°C

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC - F1	0.1 - 10	-	0.3	0.6	dB
		F1 - F2	10 - 20	-	0.8	1.2	
		F2 - F3	20 - 30	-	1.3	2.0	
	Return Loss	DC - F1	0.1 - 10	-	15	-	dB
		F1 - F2	10 - 20	-	9	-	
		F2 - F3	20 - 30	-	8	-	

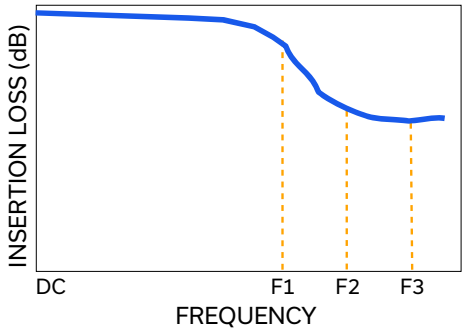
1. Tested on Evaluation Board P/N TB-TPHKI-3002C+. Measured with the connector and feedline effects de-embedded using the 2X Thru IEEE P370 method.
2. Bi-directional, RF1 and RF2 ports can be interchanged.
3. This component should not be used as a DC-block. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.

ABSOLUTE MAXIMUM RATINGS[4]

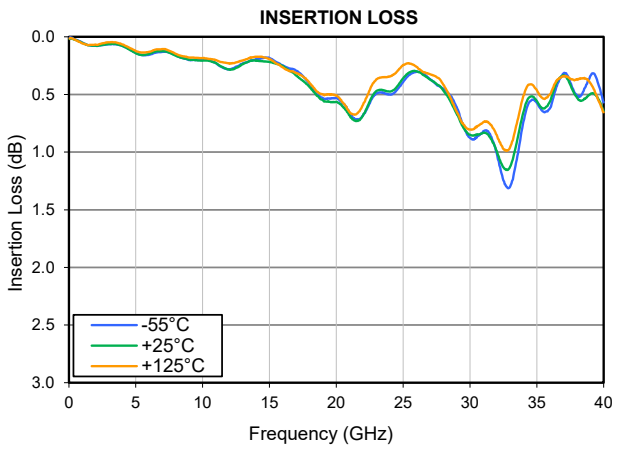
Parameter	Ratings
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
RF Power Input [5]	1 W

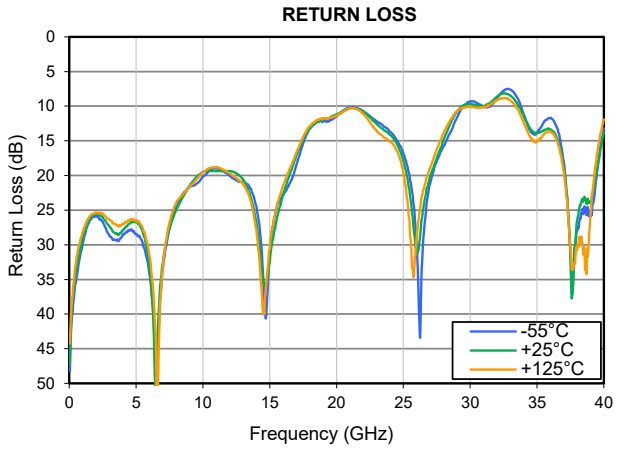
4. Permanent damage may occur if any of these limits are exceeded.
5. Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 0.5 W at +125°C.

TYPICAL FREQUENCY RESPONSE AT +25°C



TYPICAL PERFORMANCE GRAPHS





Thru-Line

TPHKI-3002+

50Ω DC to 30 GHz

FUNCTIONAL DIAGRAM

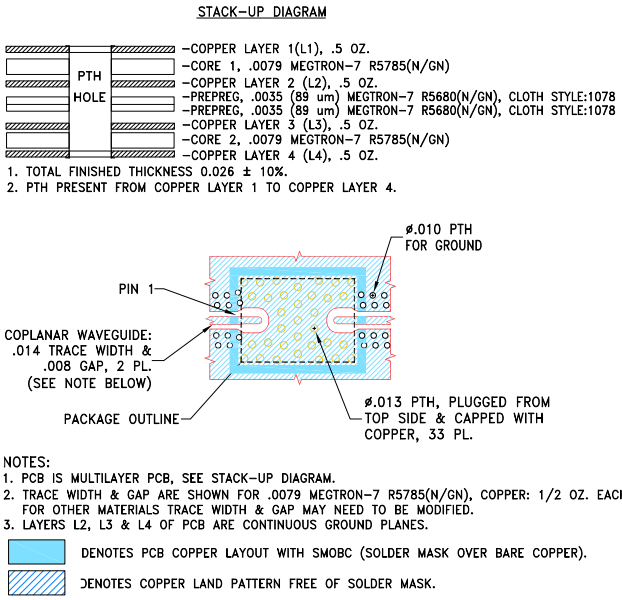


Figure 1. TPHKI-3002+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF1[2]	1	Connects to RF Input Port
RF2[2]	2	Connects to RF Output Port
GROUND	3	Connects to Ground on PCB, (See drawing PL-767)

SUGGESTED PCB LAYOUT (PL-767)



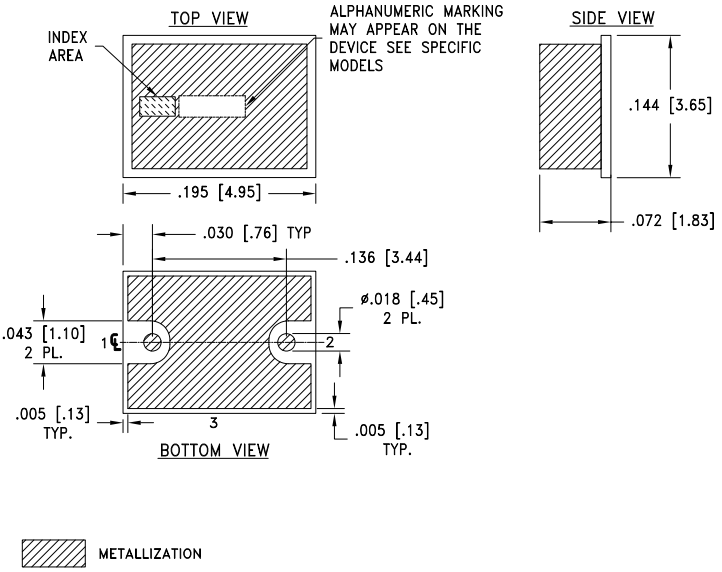
NOTES:
1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP ARE SHOWN FOR .0079 MEGTRON-7 R5785(N/GN), COPPER: 1/2 OZ. EACH LAYER. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. LAYERS L2, L3 & L4 OF PCB ARE CONTINUOUS GROUND PLANES.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Figure 2. Suggested PCB Layout PL-767

CASE STYLE DRAWING



Weight: .135 grams.
Dimensions are in inches [mm]. Tolerances: 2 Pl.±.01; 3 Pl. ±.005

PRODUCT MARKING*: F446

*Marking may contain other features or characters for internal lot control.

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD. CLICK HERE

Performance Data & Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads
Case Style	NM3237 Lead Finish: Gold over Nickel Plating.
RoHS Status	Compliant
Tape and Reel	F77
Suggested Layout for PCB Design	PL-767
Evaluation Board	TB-TPHKI-3002C+ Gerber File
Environmental Rating	ENV06T12

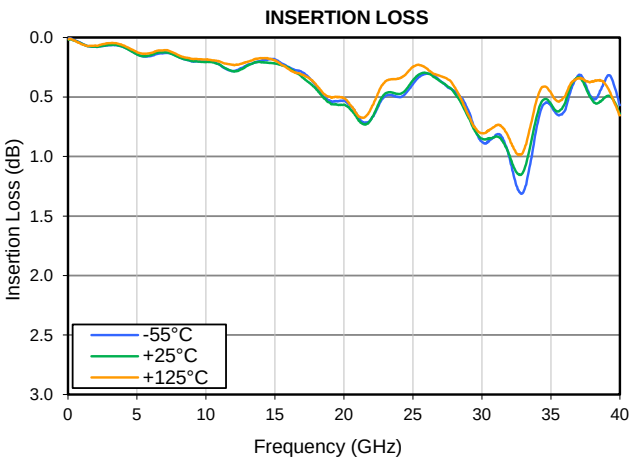
NOTES

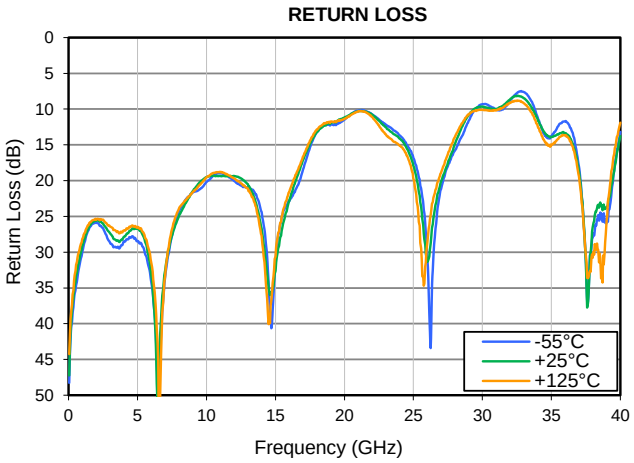
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Typical Performance Data

FREQUENCY (GHz)	INSERTION LOSS (dB)			RETURN LOSS (dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
0.1	0.00	0.01	0.01	44.27	43.37	41.32
1.0	0.05	0.05	0.06	29.94	29.15	28.16
2.0	0.08	0.08	0.07	25.93	25.63	25.48
3.0	0.06	0.06	0.05	28.64	27.33	26.41
4.0	0.08	0.08	0.07	28.51	27.84	26.95
5.0	0.14	0.14	0.12	28.43	26.68	26.46
6.0	0.16	0.15	0.13	34.23	33.19	31.42
7.0	0.13	0.12	0.11	33.54	32.53	33.24
8.0	0.16	0.16	0.15	24.34	24.99	23.94
9.0	0.20	0.20	0.18	21.66	21.48	21.62
10.0	0.20	0.21	0.19	20.19	19.50	19.55
11.0	0.23	0.23	0.20	18.98	19.36	18.82
12.0	0.28	0.28	0.23	20.04	19.36	19.71
13.0	0.23	0.24	0.21	20.94	20.49	21.11
14.0	0.20	0.21	0.18	24.41	26.68	27.71
15.0	0.19	0.22	0.19	31.53	32.60	30.59
16.0	0.25	0.25	0.26	22.87	22.86	21.61
17.0	0.29	0.34	0.32	18.44	17.13	16.65
18.0	0.41	0.44	0.40	13.16	13.21	12.81
19.0	0.53	0.55	0.50	12.18	11.96	11.75
20.0	0.53	0.56	0.51	11.48	11.18	11.36
21.0	0.66	0.68	0.65	10.21	10.31	10.32
22.0	0.68	0.68	0.59	10.72	10.77	11.09
23.0	0.49	0.47	0.37	12.16	12.54	13.52
24.0	0.50	0.47	0.34	13.69	14.12	15.12
25.0	0.39	0.36	0.25	16.85	17.87	19.72
26.0	0.30	0.30	0.26	30.67	31.35	28.79
27.0	0.37	0.37	0.32	21.19	20.18	18.93
28.0	0.45	0.47	0.41	15.81	14.88	13.88
29.0	0.61	0.67	0.65	11.64	10.79	10.68
30.0	0.88	0.85	0.80	9.30	9.67	10.10

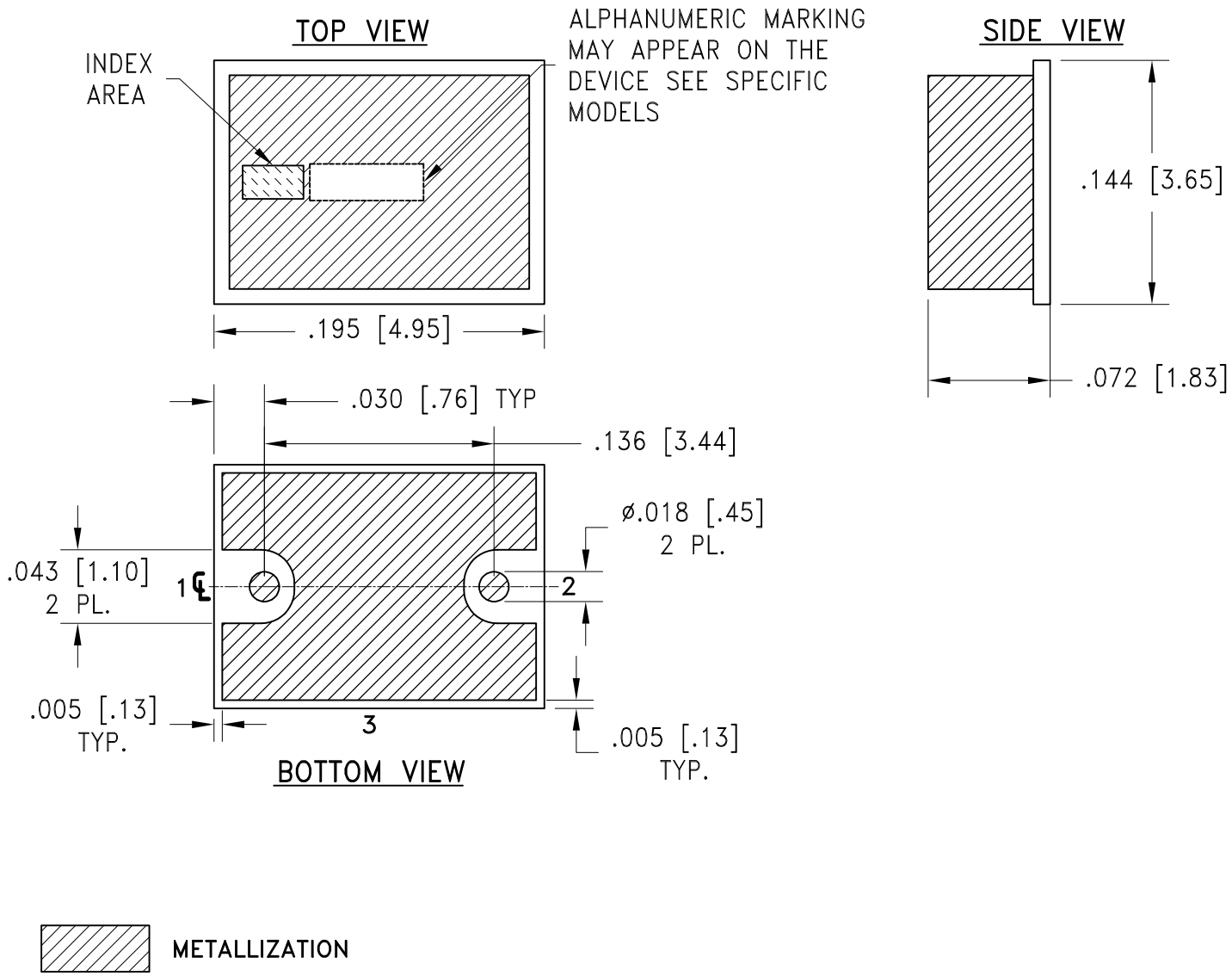
Typical Performance Data





Case Style NM

Outline Dimensions NM3237



Weight: .135 grams.

Dimensions are in inches (mm). Tolerances: 2 Pl.±.01; 3 Pl. ±.005

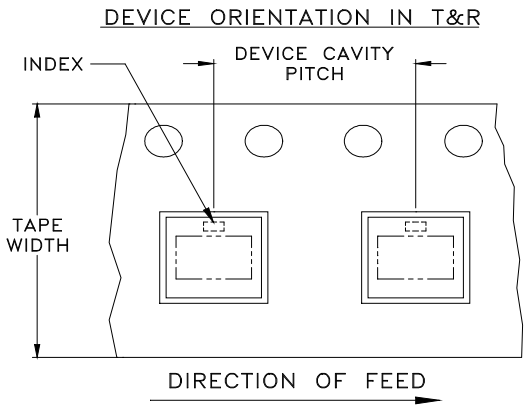
Notes:

1. Case material: LTCC on printed circut board base.
2. Termination Finish: **as shown below or indicated on Data Sheet.**
   For RoHS Case Styles: Gold Plate over Nickel plate. All models, (+) suffix.

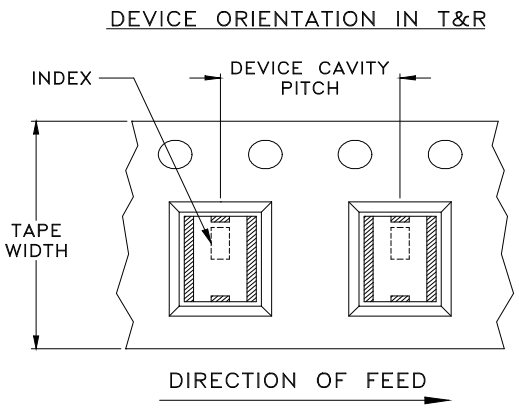
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Tape & Reel Packaging TR-F77



Note: The shape of the pocket may differ



Note: The location and shape of the metallization may differ

Applicable Case Styles
GU1604, GU1804, GU2644, TT1618-2

Applicable Case Styles
MZ4532C, NM1812C, NM1812C-1, NM1812C-2, NM1812C-3, NM1812C-5, NM1812C-6, NM3237 NM1812C-9

Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
12	8	7	Small quantity standards (see note)	20
				50
				100
				200
				500
				1000
		13	Standard	2000

Note: Please Consult individual model data sheet to determine device per reel availability.

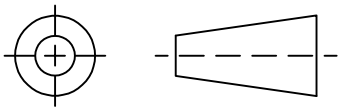
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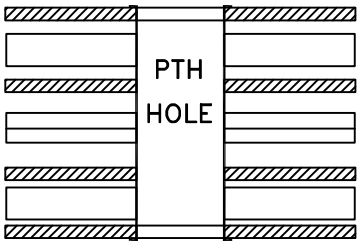
THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-019771	NEW RELEASE	11/06/23	ITG	IL

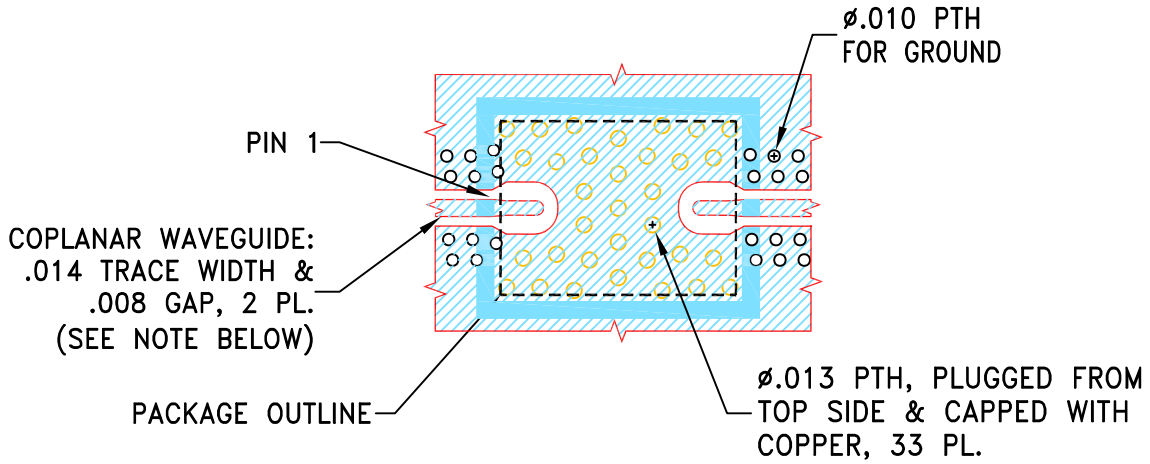
SUGGESTED MOUNTING CONFIGURATION FOR NM3237 CASE STYLE

STACK-UP DIAGRAM



-COPPER LAYER 1(L1), .5 OZ.
-CORE 1, .0079 MEGTRON-7 R5785(N/GN)
-COPPER LAYER 2 (L2), .5 OZ.
-PREPREG, .0035 (89 um) MEGTRON-7 R5680(N/GN), CLOTH STYLE:1078
-PREPREG, .0035 (89 um) MEGTRON-7 R5680(N/GN), CLOTH STYLE:1078
-COPPER LAYER 3 (L3), .5 OZ.
-CORE 2, .0079 MEGTRON-7 R5785(N/GN)
-COPPER LAYER 4 (L4), .5 OZ.

1. TOTAL FINISHED THICKNESS 0.026 ± 10%.
2. PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.



NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP ARE SHOWN FOR .0079 MEGTRON-7 R5785(N/GN), COPPER: 1/2 OZ. EACH LAYER. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. LAYERS L2, L3 & L4 OF PCB ARE CONTINUOUS GROUND PLANES.



DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	ITG	11/06/23
TOLERANCES ON:	CHECKED	GF	11/06/23
2 PL DECIMALS ±	APPROVED	IL	11/06/23
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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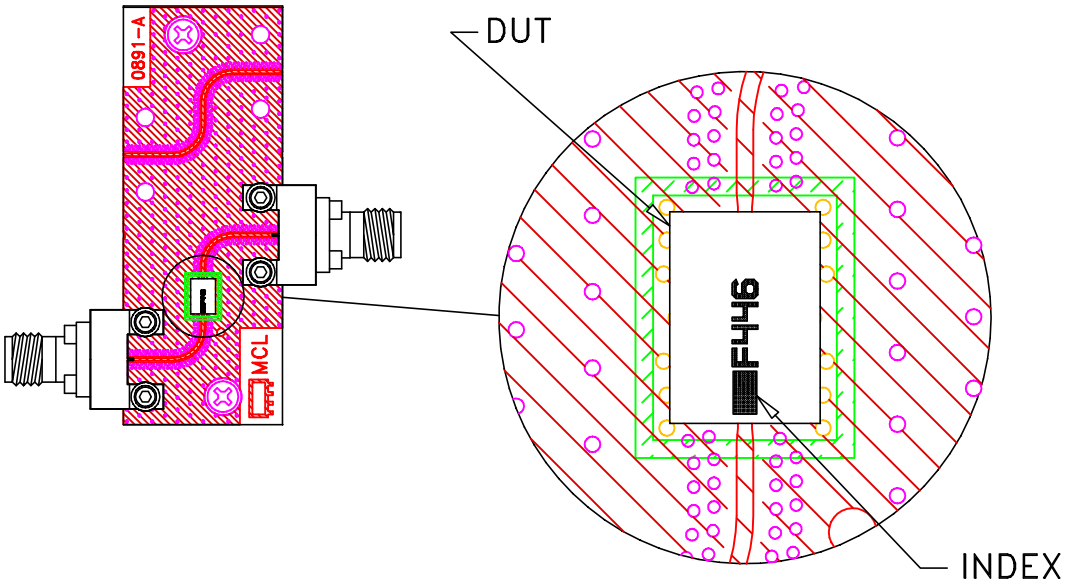
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PL,NM3237, TB-BFHKI-XXXXC+

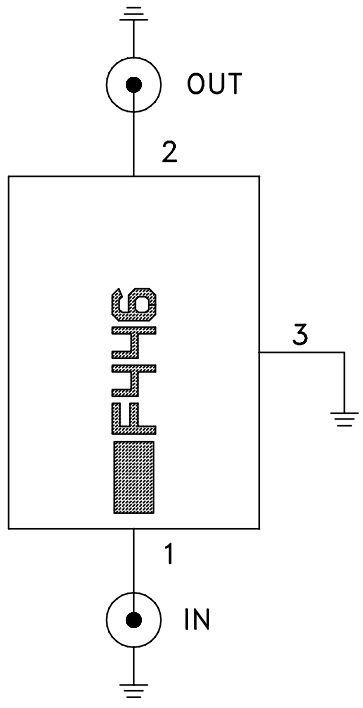
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-767	OR

FILE:	SCALE:	SHEET:
98PL767	6:1	1 OF 1

Evaluation Board and Circuit



TB-TPHKI-3002C+



Schematic Diagram

1. 50 Ohm 2.92 mm Female end Launch connectors.
2. PCB Material: MEGTRON-7 R5785(N or GN) or equivalent, Dielectric Constant=3.37 Thickness=.0079 inch.

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Environmental Specifications ENV06T12

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-55° to 125° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 125° C Ambient Environment	Individual Model Data Sheet
Thermal Cycling	-55 to 125°C, 100 cycles, Dwell Time 15 minutes.	MIL-STD-202, Method 107, Condition A-3
Humidity	85°C, 90-95% Relative Humidity, 250hours	
Solderability	10X / 30X Magnification	J-STD-002C Test S, J-STD-002C Test S1
High Temp Storage	125°C, 250 hours	
Bend Test	1mm, deflection for 5 seconds Span of bending: 2.75"	--

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